Chapter 1

Raw Materials Supply for Cement and Aggregate Industry

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1. RAW MATERIAL SUPPLY TO CEMENT AND AGGREGATE INDUSTRY

The basis for all business the in cement and aggregate industry is adequate supplies of raw material. This raw material is found in nature in form of rock formations. In order to find and secure sufficient reserves of such rock formations exploration work is conducted. The actual production is gained from open cast mining of a raw material deposit (any volume of rock can represent a raw material deposit) in most cases. Picture 1 depicts a typical quarry for a cement factory. It becomes very evident that the meaning of a quarry is to dig a hole into the landscape. Considering the fact that for the production of clinker or aggregates certain qualities of rock are needed, it is of paramount interest to the plant to know beforehand what type of rock and what quality will be encountered within the mountain, behind the quarry faces.

Picture 1 The Quarry, source of raw materials

Picture 1: The Quarry, source of raw materials

This need for information before mining starts is the classical problem of exploration.

Two main aspects are to be considered:

- Geometry of the raw material deposit, that means geological boundaries like interfaces of formations, faults and also topography
- Quality of the rocks in terms of chemical and mineralogical composition, physical characteristics like hardness, abrasiveness, pozzolanic activity.

Obviously this task of exploration is not a simple one. Our means of acquiring data is limited compared to the large size of rock volumes to be investigated. Exploration drillings provide precise but also very spotty information on the rock volumes. In order to fill the gaps

between drillholes and also in order to interpret results of drillings, we need a model of the raw material deposit. This model is developed with the help of the natural science GEOLOGY. Within this science, all aspects with respect to rock formation, deformation and transformation are studied and general rules are established. These concepts of geology are absolutely instrumental for the interpretation of any raw material deposit.

The application of geology is, however, also an ambiguous matter. There are hardly two geologists who are of the same opinion on a given raw material deposit. This fact creates confusion especially amongst engineers, who are used to well-defined systems, expressed in precise figures. Exactly these precise figures can never be provided by the geologists, because of the inherent ambiguities of the geology. Why is that so?

Geology is a relatively young natural science. It is part of nature and hence very tricky. The development of this science is not as advanced as, for example, chemistry or physics. The reason for this lies in the complexity of the subject. It represents a combination of every conceivable combination of physical, chemical and biological processes at all scales.

Many phenomenons observed in nature are not understood and related processes are not controlled by scientists. A good example of this fact is the inability to predict earthquakes.

A further reason lies in the fact that geology deals with very different dimensions, from the very tiny atoms and molecules to finally the whole globe. Especially the large dimensions are difficult to overcome.

Additionally geology deals with a very long time span. It is an ambitious task to reconstruct the history of a given rock because of the scarce information. Normally such a history has to be pieced together the geologist is obliged to use his imagination to fill in gaps in the information.

Nevertheless, the geological concepts are the only help in the interpretation of raw material deposits. In order to arrive at the best possible interpretation, it is important to ask the most adequate person for an opinion. Considering the many different specialists which exist in the field of geology (see table 1), the choice is not always easy. Very often different specialists contribute to the erection of a geological model for a raw material deposit. As for instance in the field of medicine, it is important to select the correct specialist for the purpose in mind (nobody would select as gynaecologist for an appendix operation).

Because of the difficulties described, the results of geological studies are often qualitative. For the design of a cement or aggregate plant, however, the engineers require quantitative results. Also from this side emerges a problem of communication between geologists and engineers. This is expressed in the fact that qualitative statements of the geologists are discarded by engineers, and that they the base the design of equipment on shaky but apparently precise figures. The result of this practice can be very costly. It is the aim of the following lessons to improve on this special communication between geologists and engineers.

- The geologists have to learn that quantification is an absolute must in our industry
- The engineers have to learn that no raw material deposit is homogenous and no deposit can be characterized by precise figures alone.

Table 1

Geological Specialities
Stratigraphy/Biostratigraphy
Igneous Geology
Volcanology
Sedimentology
Structural Geology/Tectonics
Paleontology/Micropaleontology
Palynology
Geochemistry
Hydrology
Geophysics
Oil Geology
Engineering Geology
Paleogeography

TABLE 2

Type of raw materials used in the cement and aggregate industry	
limestone	clinker/lime production aggregates
claystone/shale	clinker production expanded clay
iron-ore	corrective material clinker production
bauxite	corrective material clinker production
laterite	corrective material clinker production
kaolinite	white cement production
gypsum	cement additive
pozzolana	cement additive
sand/gravel	aggregates
crushed stone (granite, diorite, basalt etc.)	aggregates